

# THE LANCET

## Healthy Longevity

### **Supplementary appendix**

This appendix formed part of the original submission and has been peer reviewed.  
We post it as supplied by the authors.

Supplement to: Navaratnam AV, Gray WK, Day J, et al. Patient factors and temporal trends associated with COVID-19 in-hospital mortality in England: an observational study using administrative data. *Lancet Healthy Longev* 2021; published online Feb 15. [https://doi.org/10.1016/S2213-2600\(20\)30579-8](https://doi.org/10.1016/S2213-2600(20)30579-8).

**Supplementary material Table S1: Multilevel logistic regression models of factors associated with in-hospital mortality**

Variable	Model 1 (demographics and deprivation), Odds ratios (95% CIs)	Model 2 (demographics, deprivation and time), Odds ratios (95% CIs)	Model 3 (demographics, deprivation, time and frailty), Odds ratios (95% CIs)	Model 4 (demographics, deprivation, time and comorbidity), Odds ratios (95% CIs)
<b>Age band (years)</b>				
18-39 (reference)	1 (reference)	1 (reference)	1 (reference)	1 (reference)
40-49	2.220 (1.842 to 2.674)	2.219 (1.841 to 2.674)	2.211 (1.834 to 2.665)	2.053 (1.702 to 2.476)
50-59	5.156 (4.373 to 6.080)	5.218 (4.423 to 6.156)	5.238 (4.439 to 6.180)	4.558 (3.861 to 5.382)
60-69	10.550 (9.985 to 12.388)	10.931 (9.305 to 12.842)	8.202 (6.946 to 9.686)	8.693 (7.390 to 10.224)
70-79	19.216 (16.399 to 22.517)	20.271 (17.290 to 23.766)	10.811 (9.077 to 12.878)	14.706 (12.520 to 17.274)
≥ 80	29.989 (25.623 to 35.099)	32.978 (28.161 to 38.621)	15.922 (13.371 to 18.959)	22.437 (19.110 to 26.343)
<b>Sex</b>				
Female	1 (reference)	1 (reference)	1 (reference)	1 (reference)
Male	1.481 (1.433 to 1.530)	1.450 (1.402 to 1.499)	1.479 (1.430 to 1.530)	1.432 (1.384 to 1.482)
<b>Deprivation quintile</b>				
5 (least deprived)	1 (reference)	1 (reference)	1 (reference)	1 (reference)
4	1.033 (0.976 to 1.093)	1.042 (0.984 to 1.103)	1.031 (0.973 to 1.092)	1.026 (0.968 to 1.088)
3	1.104 (1.044 to 1.168)	1.133 (1.070 to 1.199)	1.115 (1.053 to 1.181)	1.100 (1.039 to 1.166)
2	1.091 (1.032 to 1.153)	1.120 (1.059 to 1.185)	1.094 (1.034 to 1.158)	1.072 (1.012 to 1.135)
1 (most deprived)	1.121 (1.060 to 1.186)	1.156 (1.092 to 1.224)	1.117 (1.054 to 1.183)	1.082 (1.020 to 1.147)
<b>Ethnicity</b>				
White	1 (reference)	1 (reference)	1 (reference)	1 (reference)
Asian	1.236 (1.156 to 1.322)	1.172 (1.094 to 1.254)	1.229 (1.147 to 1.316)	1.185 (1.105 to 1.271)
Black	1.101 (1.016 to 1.192)	1.021 (0.942 to 1.107)	1.068 (0.985 to 1.159)	1.003 (0.923 to 1.089)
Mixed	1.258 (1.038 to 1.525)	1.235 (1.016 to 1.500)	1.305 (1.073 to 1.587)	1.284 (1.053 to 1.565)
Other	0.952 (0.862 to 1.051)	0.929 (0.841 to 1.028)	0.972 (0.878 to 1.075)	0.970 (0.875 to 1.074)
<b>Period of discharge (alive or following death)</b>				
24 <sup>th</sup> to 31 <sup>st</sup> May	-	1 (reference)	1 (reference)	1 (reference)
10 <sup>th</sup> to 23 <sup>rd</sup> May	-	0.968 (0.881 to 1.064)	0.967 (0.880 to 1.063)	0.966 (0.878 to 1.063)
26 <sup>th</sup> April to 9 <sup>th</sup> May	-	1.300 (1.189 to 1.421)	1.312 (1.199 to 1.435)	1.339 (1.222 to 1.466)
12 <sup>th</sup> to 25 <sup>th</sup> April	-	1.880 (1.725 to 2.050)	1.961 (1.798 to 2.139)	2.016 (1.847 to 2.202)
29 <sup>th</sup> March to 11 <sup>th</sup> April	-	2.583 (2.369 to 2.816)	2.844 (2.607 to 3.104)	2.868 (2.626 to 3.132)
15 <sup>th</sup> to 28 <sup>th</sup> March	-	2.749 (2.479 to 3.048)	3.080 (2.775 to 3.418)	3.001 (2.701 to 3.333)
1 <sup>st</sup> to 14 <sup>th</sup> March	-	2.670 (1.896 to 3.761)	2.909 (1.060 to 4.108)	2.874 (2.019 to 4.091)
<b>Hospital Frailty Risk Score band</b>				
None	-	-	1 (reference)	-
Mild	-	-	1.018 (0.931 to 1.115)	-
Moderate	-	-	2.004 (1.854 to 2.166)	-
Severe	-	-	2.419 (2.234 to 2.619)	-
<b>Charlson Comorbidity Index items*</b>				
Peripheral vascular disease	-	-	-	1.230 (1.148 to 1.318)
Congestive heart failure	-	-	-	1.634 (1.562 to 1.708)
Acute myocardial infarction	-	-	-	1.078 (1.021 to 1.137)
Cerebrovascular disease	-	-	-	1.184 (1.118 to 1.254)
Dementia	-	-	-	1.540 (1.473 to 1.610)
Chronic pulmonary disease	-	-	-	1.081 (1.042 to 1.123)
Connective tissue disease/rheumatic disease	-	-	-	1.226 (1.120 to 1.343)
Peptic ulcer	-	-	-	1.048 (0.858 to 1.279)
Mild liver disease	-	-	-	1.000 (0.902 to 1.108)
Moderate or severe liver disease	-	-	-	5.345 (4.542 to 6.289)
Diabetes without chronic complications	-	-	-	1.146 (1.103 to 1.191)
Diabetes with chronic complications	-	-	-	1.271 (1.157 to 1.396)
Paraplegia and hemiplegia	-	-	-	1.144 (1.084 to 1.209)
Renal disease	-	-	-	1.171 (1.146 to 1.195)
Primary cancer	-	-	-	1.546 (1.449 to 1.650)
Metastatic carcinoma	-	-	-	2.042 (1.860 to 2.243)
Obesity	-	-	-	1.438 (1.347 to 1.535)

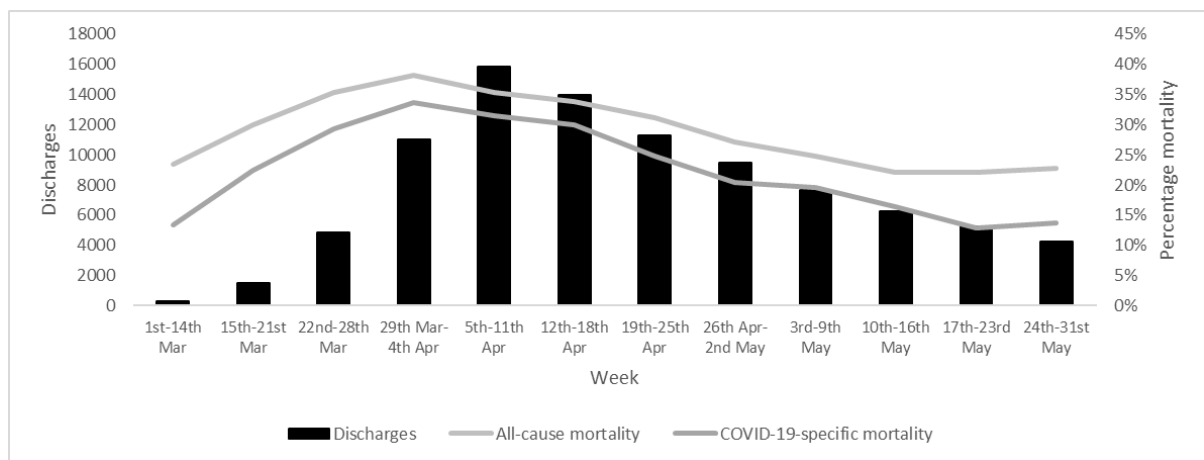
Models are based on data for 79,124 patients with no missing data. A stable odds ratio for the comorbidity HIV/AIDS could not be calculated due to small numbers. \* For Charlson Comorbidity Index items the reference category is patients without the specified comorbidity. For Charlson Comorbidity Index items relating to liver disease, diabetes and cancer three mutually exclusive categories were used. CI = confidence interval

**Supplementary material Table S2: Multilevel logistic regression model predicting in-hospital mortality of variables for the full dataset and for only those with test confirmed COVID-19**

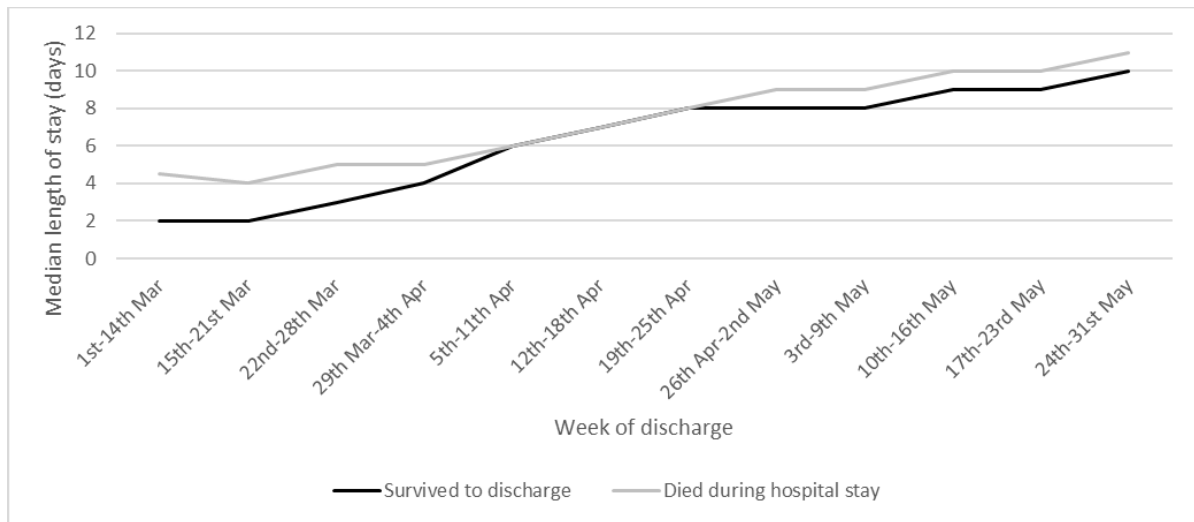
Variable	Full dataset (odds ratios (95% CIs))	Only test confirmed COVID-19 (odds ratios (95% CIs))
<b>Age</b>		
Spline 1	1.074 (1.070 to 1.077)	1.073 (1.069 to 1.076)
Spline 2	0.979 (0.976 to 0.982)	0.979 (0.976 to 0.982)
<b>Sex</b>		
Female	1 (reference)	1 (reference)
Male	1.457 (1.408 to 1.509)	1.496 (1.441 to 1.553)
<b>Deprivation score</b>	1.002 (1.001 to 1.003)	1.002 (1.001 to 1.003)
<b>Ethnicity</b>		
White	1 (reference)	1 (reference)
Asian	1.211 (1.128 to 1.299)	1.191 (1.104 to 1.285)
Black	1.015 (0.935 to 1.103)	0.994 (0.909 to 1.087)
Mixed	1.317 (1.080 to 1.605)	1.261 (1.015 to 1.565)
Other	0.989 (0.893 to 1.096)	0.993 (0.889 to 1.108)
<b>Date of discharge (alive or following death)</b>	0.977 (0.976 to 0.978)	0.975 (0.974 to 0.976)
<b>Charlson Comorbidity Index items*</b>		
Peripheral vascular disease	1.227 (1.146 to 1.315)	1.218 (1.129 to 1.313)
Congestive heart failure	1.606 (1.535 to 1.681)	1.621 (1.542 to 1.703)
Acute myocardial infarction	1.073 (1.016 to 1.132)	1.097 (1.034 to 1.163)
Cerebrovascular disease	1.176 (1.110 to 1.245)	1.148 (1.079 to 1.221)
Dementia	1.496 (1.431 to 1.565)	1.463 (1.395 to 1.534)
Chronic pulmonary disease	1.089 (1.049 to 1.130)	1.117 (1.072 to 1.163)
Connective tissue disease/rheumatic disease	1.242 (1.134 to 1.360)	1.236 (1.120 to 1.363)
Peptic ulcer	1.056 (0.865 to 1.289)	1.014 (0.816 to 1.261)
Mild liver disease	1.017 (0.917 to 1.127)	0.952 (0.849 to 1.067)
Moderate or severe liver disease	5.433 (4.618 to 6.392)	4.558 (3.791 to 5.480)
Diabetes without chronic complications	1.159 (1.115 to 1.204)	1.166 (1.118 to 1.216)
Diabetes with chronic complications	1.295 (1.179 to 1.422)	1.287 (1.165 to 1.423)
Paraplegia and hemiplegia	1.154 (1.093 to 1.219)	1.135 (1.070 to 1.204)
Renal disease	1.158 (1.134 to 1.182)	1.167 (1.141 to 1.193)
Primary cancer	1.542 (1.445 to 1.646)	1.541 (1.435 to 1.654)
Metastatic carcinoma	2.053 (1.870 to 2.255)	1.900 (1.709 to 2.113)
Obesity	1.476 (1.383 to 1.575)	1.508 (1.406 to 1.618)

Models are based on data for 79,124 patients with no missing data for the full dataset and 64,571 patients for the test-confirmed COVID-19 dataset. Age is modelled in years and deprivation as the Index of Multiple Deprivation score. A stable odds ratio for the comorbidity HIV/AIDS could not be calculated due to small numbers. Significant relationships are marked in bold. \* For Charlson Comorbidity Index items the reference category is patients without the specified comorbidity. For Charlson Comorbidity Index items relating to liver disease, diabetes and cancer three mutually exclusive categories were used. CI = confidence interval

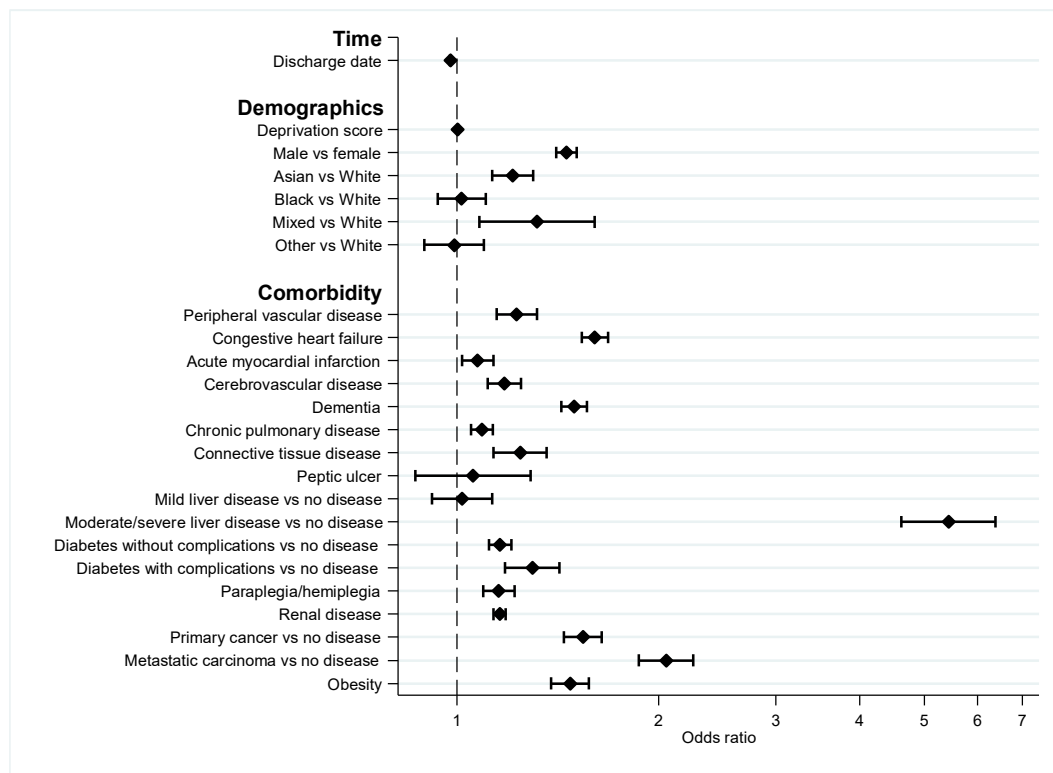
**Supplementary material Figure S1: Unadjusted hospital discharges, all-cause mortality and COVID-19-specific mortality over time**



**Supplementary material Figure S2: Weekly length of stay for those who survived to discharge and those who died during their hospital stay**



**Supplementary material Figure S3: Plot of odds ratios for the final model for continuous linear and categorical variables**



**Supplementary material Figure S4: Discharges and deaths in all patients and discharges and deaths only for patients with test-confirmed COVID-19 over time**

